Calendar Year 2015
Annual Progress Report to the Collaborative Science Policy Group

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The Collaborative Adaptive Management Team (CAMT)

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1.0 Introduction

This document provides the third annual progress report on the Collaborative Science and Adaptive Management Program (CSAMP or Program) being undertaken in the Sacramento—San Joaquin River Delta. The report documents the activities, achievements, and future plans of the program's Collaborative Adaptive Management Team (CAMT) operating under the leadership and guidance of the Collaborative Science Policy Group (Policy Group).

The report includes highlights of ongoing collaboration (including accomplishments from 2015), CAMT goals for 2016, and an updated CAMT work plan and budget. Throughout the report, the term "CSAMP" is used to refer to the overall process, which encompasses the CAMT and the Policy Group. The term "CAMT" refers specifically to the team of individuals that make up CAMT.

In many ways, 2015 was a transitional year for the CSAMP. The Program transitioned from a court-ordered initiative to voluntary collaboration continuing to pursue common goals. The Program also transitioned from largely planning and scoping technical investigations to contracting and managing those studies.

The transition process will continue in 2016, as Program initiatives begin to produce findings and the CAMT and the Policy Group begin to address the potential management implications of those findings. In addition, the CSAMP is expected to continue developing its organizational capacity and engagement, particularly at the Policy Group level, combined with more coordination with other science programs such as the Interagency Ecological Program (IEP) and the Delta Stewardship Council's High Impact Science Actions to leverage capabilities and focus efforts. Finally, the CAMT plans to develop a Five Year Plan in 2016 that will identify priorities for future collaborative efforts and improve public transparency.

1.1 History

The CSAMP was launched following a decision by the United States District Court for the Eastern District of California on April 9, 2013. The decision entitled "Memorandum Decision and Order regarding Motion to Extend Remand Schedule" (Court Order) was issued in response to a motion to extend the court-ordered remand schedule for completing revisions to salmonid and Delta Smelt Biological Opinions (BiOps).

The Court Order allowed the parties making the motion (i.e., U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the California Department of Water Resources) additional time for the development of a proposed robust science and adaptive management program, with collaboration of the scientists and experts from the Public Water Agencies ('PWAs') and the NGO community with the intent to inform the management actions incorporated into the existing BiOps

(and Reasonable and Prudent Alternatives) and consideration of alternative management actions.

In April 2013, the Court granted a one-year extension of time. The parties filed an annual progress report in February 2014, and the Court granted a second one-year extension in March 2014. The parties prepared a second annual progress report in February 2015, requesting a third one-year extension. In the intervening period, however, the Ninth Circuit reversed the Court's decision with respect to the smelt and salmonid BiOps and issued a final judgment, thereby ending the Court Order.

In the absence of the Court Order, in 2015 all parties agreed to continue the CSAMP to promote the collaborative development of scientific information to inform sound decision-making in the future.

1.2 Organization

The CSAMP is structured as a four-tiered organization comprised of:

1. Policy Group consisting of agency directors and top-level executives from the entities that created CSAMP;
2. CAMT made up of managers and staff scientists that serve at the direction of the Policy Group;
3. Scoping Teams created on an as-needed basis to scope specific science studies; and
4. Investigators contracted to conduct studies.

A listing of current Policy Group, CAMT, and scoping team members is provided at the beginning of this report.

1.3 Mission Statement

The CAMT mutually agreed on the following mission statement at its July 23, 2013 meeting:

> The Collaborative Adaptive Management Team (CAMT) will work, with a sense of urgency, to develop a robust science and adaptive management program that will inform both the implementation of the current Biological Opinions, including interim operations; and the development of revised Biological Opinions.

CAMT has not updated its mission statement to reflect that revised Biological Opinions are no longer required. However, CAMT expects to revisit its mission statement during development of a Five Year Plan in 2016 (see Section 3). In the meantime, CAMT intends to remain focused on completing the studies initiated in 2014, informing the CSAMP policy members of the results of those studies, and identifying new initiatives as the early work is completed.

2.0 Highlights of Ongoing Collaboration

2.1 Technical Studies

Activities in 2015 focused on continued implementation of high priority work plan elements outlined in the CAMT 2014 and 2015 Workplans, as described in the CAMT 2013 and 2014 Annual Progress Reports (February 2014 and February 2015) including:

1. Improved application of Delta Smelt survey data;
2. Old and Middle River (OMR) flow management and entrainment of Delta Smelt;
3. Fall outflow management for Delta Smelt; and
4. South Delta salmonid survival.

These work plan elements are specifically intended to address the following key management questions:

1. What factors affect adult Delta Smelt entrainment, and how can these factors be defined and managed to reduce entrainment risk?
2. What are the effects of entrainment on the Delta Smelt population?
3. Are there biases in the Delta Smelt survey data, and if so how should the survey data be utilized?
4. Under what circumstances do environmental conditions in the fall, including fall outflow contribute to determining the subsequent abundance of Delta Smelt?
5. How do project operations affect salmonid behavior and survival in the south Delta, and are there more effective and/or efficient management actions that could be implemented in 2016 to improve salmonid survival in the south Delta while providing for greater water supply reliability?

Activities in 2015 included reviewing and finalizing technical proposals, securing funding, executing contracts, conducting investigations and discussing preliminary findings. To date, the technical studies have focused on review, analyses, and modeling using existing information, as opposed to collecting new data.

Specific accomplishments in 2015 included:

- Preparation of a revised draft Salmonid Gap Analysis Report, including draft responses to eight key management questions (Attachment B, Table B-4);
- Independent review and finalization of the proposal and initiation of a study to investigate Delta Smelt entrainment, and the population impacts of entrainment;
- Independent review and finalization of a proposal to examine Delta Smelt survey data;
- Independent review and finalization of a proposal to examine the effects of fall outflow on Delta Smelt.
- Secured funding and contracting mechanisms to implement the four studies listed above.

Table 1 lists the status of the work elements identified in CAMT's 2014 Workplan. All "ongoing" items are being addressed in the current CAMT technical studies, as summarized below. All "future activity" items will be reviewed for inclusion in the Five Year Plan (see Section 3).

Table 1 - Status of 2014 Workplan Elements

Work Element	Status	Comments
Improved Application of Delta Smelt Survey Data		
1-1 Review monitoring survey methods for Delta Smelt.	Ongoing	Proposal reviewed and finalized in 2015. Funding secured and contract executed. Initiate study in 2016.
Fall Outflow Management for Delta Smelt		
1-2 Investigate importance of fall period for Delta Smelt.	Ongoing	Proposal developed and reviewed in 2015. Funding secured and contracting underway. Initiate study in 2016.
1-3 Investigate effects of fall outflow on Delta Smelt.	Ongoing	Proposal developed and reviewed in 2015. Funding secured and contracting underway. Initiate study in 2016. Integrated into item 1-2 above.
1-4 Examine project impacts on fall outflow.	Future activity	Secondary priority in 2014 Workplan..
1-5 Investigate importance of summer period for Delta Smelt	Future activity	Secondary priority in 2014 Workplan.
1-6 Investigate relationship between fall outflow and habitat attributes.	Ongoing	Being addressed as part of 1-2 above.
OMR Management and Delta Smelt Entrainment		
2-1 Assess factors affecting adult Delta Smelt entrainment.	Ongoing	Proposal finalized, funding secured, and contract executed in 2015. Study underway.
2-2 Assess population effects of entrainment on Delta Smelt.	Ongoing	Combined with 2-1 above.
2-3 Develop a better estimate of adult Delta Smelt entrainment.	Ongoing	Combined with 2-1 above.
2-4 Develop a better estimate of post-larval Delta Smelt entrainment	Future activity	Secondary priority in 2014 Workplan.
2-5 Evaluate conditions that affect adult movement prior to spawning	Future activity	Secondary priority in 2014 Workplan.
2-6 Assess factors affecting larval and post-larval Delta Smelt entrainment	Future activity	Secondary priority in 2014 Workplan.
2-7 Explore alternative management actions	Future activity	Secondary priority in 2014 Workplan.

Work Element	Status	Comments
South Delta Salmonid Survival		
3-1 Synthesize published reports and empirical data on water export affects and document scientific agreements and disagreements regarding the effects of south Delta water operations on juvenile salmonid survival in the Delta (gap analysis).	Ongoing	Revised draft report prepared in 2015. Report to be finalized in 2016.
3-2 Provide a briefing about SWFSC winter-run salmonid life cycle model (LCM).	Completed	
3-3 Prepare data synthesis and meta-analysis.	Ongoing	Combined with 3-1 above.
3-4 Pending results of the gap analysis and initial data synthesis efforts, investigate alternative metric(s) for management of south Delta water operations.	Ongoing	Identified as a key management question in 2015 and combined with 3-1 above.
3-5 Re-charter the SDSRC.	Completed	
3-6 Pending outcomes of Elements 3-1, 3-3, and 3-4, investigate tools to evaluate the efficacy of export management actions.	Future activity	Secondary priority in 2014 Workplan.
3-7 After briefing on SWFSC LCM, assessment of other potential modeling needs. Pending outcomes of Element 3-1 through 3-4 identify and evaluate indirect ecological effects of project operations that affect salmonid survival.	Future activity	Secondary priority in 2014 Workplan.
3-8 Define an expanded scope to include indirect ecological effects of south Delta water operations	Future activity	Secondary priority in 2014 Workplan.
3-9 Enhanced learning from 6-year steelhead study (NMFS BiOp RPA VI.2.2)	Future activity	Secondary priority in 2014 Workplan.
3-10 Salmonid near-field movement under selected export and tidal conditions.	Future activity	Third priority in 2014 Workplan.
3-11 Pending gap analysis, investigate hatchery-and natural-origin salmonid surrogacy.	Future activity	Third priority in 2014 Workplan.

2.1.1 Improved Application of Delta Smelt Survey Data

One of the high priority work plan elements for Delta Smelt focused on concerns regarding existing monitoring programs for Delta Smelt and the potential for unintended sampling bias that could affect various analyses regarding Delta Smelt presence/absence, movement, and distribution. In 2014, CAMT's Delta Smelt Scoping Team (DSST) received a detailed proposal for evaluating existing Delta Smelt monitoring survey data.

The study recommends evaluating foundational assumptions that underlie data analysis methods used to draw conclusions about the population status of Delta Smelt. The study would evaluate assumptions regarding catchability and temporal and spatial correlation to ensure that the survey programs in the Delta are providing reliable and accurate population metrics for Delta Smelt.

In 2015, the DSST worked with the Delta Science Program (DSP) to coordinate an independent peer review of the proposal and the Department of Water Resources (with funding assistance from the U.S. Bureau of Reclamation) executed a contract for conducting the study in 2016. A summary of the study is provided in Attachment B.

2.1.2 Old and Middle River (OMR) Flow Management and Entrainment of Delta Smelt

Two of the high priority CAMT Workplan elements identified in 2014 focused on OMR flow management and questions regarding Delta Smelt entrainment at the Central Valley Project (CVP) and State Water Project (SWP) export facilities in the south Delta (CAMT 2014 Workplan Elements 3-2-1 and 3-2-2). The first element focused on environmental factors affecting entrainment, while the second focused on the population level effects of entrainment.

In 2014, The DSST developed scopes of work for both elements and engaged a team of independent investigators to develop a detailed study proposal. An independent, design-level peer review of the proposal was completed in December 2014.

In 2015, the investigators met with the DSST to discuss review comments and potential modifications. This interaction helped to improve understanding of the proposal, promote legitimacy and advance management relevance. In June 2015, the Department of Water Resources with funding assistance from the U.S. Bureau of Reclamation executed a contract for implementing the proposal which includes four interrelated studies:

- The first study will provide a retrospective analysis of historical data to improve understanding of factors that affect entrainment risk. The study will revisit the existing conceptual models to determine if new studies or information can be used to better understand salvage patterns as an improvement from earlier investigations.

- The second study proposes using a suite of hydrodynamic, water quality, and particle tracking models, referred to collectively as an individual-based model (IBM), to identify adult Delta Smelt behaviors that best explain movement towards SWP and CVP, and entrainment.
- The third study proposes to estimate adult Delta Smelt proportional losses to SWP and CVP entrainment, using the modeling tools developed in study two above.
- The fourth study will re-examine life cycle model results published by Maunder and Deriso (2011) using updated data sets (i.e., post-2005) and revised assumptions to determine what levels of entrainment affect the viability of the Delta Smelt population.

The DSST has been actively engaging with the investigators over the past 6 months on the ongoing studies and preliminary findings from Study 1.

2.1.3 Fall Outflow Management for Delta Smelt

Another high-priority 2014 Workplan element for Delta Smelt involved looking at the importance of fall outflow. The DSST prepared a scope of work in the summer of 2014 and engaged an independent team of technical experts to prepare a detailed proposal.

In 2015, the Fall outflow investigative team delivered a detailed proposal which was subsequently subjected to an independent peer review coordinated by the DSP. Based on results of the review, the team met with the DSST to discuss potential revisions to the proposal and prepared a detailed response to comments. The Department of Water Resources and the Delta Science Program have committed funding to implement the study and are currently contracting for the work which will begin in 2016. A summary of the study is provided in Attachment B.

2.1.4 South Delta Salmonid Survival

The CAMT Salmonid Scoping Team (SST) has focused primarily on the review and synthesis of available science on water project effects on salmonid survival in the south Delta, referred to as a gap analysis. The SST prepared an initial draft Gap Analysis Report (GAR) in November 2014 synthesizing existing information and describing initial findings and recommendations.

In 2015, the SST conducted additional analyses in response to comments on the initial draft and a request from CAMT to address eight specific management questions. The SST delivered a revised draft GAR in August 2015. The SST met with CAMT in October 2015 and took additional comments on the draft report. Based on discussions with CAMT, the SST is currently finalizing the GAR for delivery to CAMT in April 2016.

The gap analysis is intended to provide CAMT with a collaboratively developed assessment of technical information regarding SWP and CVP operations' effects on Delta hydrodynamics and salmonid behavior and survival in the south Delta. The SST expects the gap analysis to inform policy and management decisions related to water

project operations in the south Delta and to yield both recommendations and guidance on future research on juvenile salmonid migration and survival within the Delta. It is anticipated that future research activities stemming from the gap analysis will be included in the Five Year Plan. A summary of the study is provided in Attachment B.

In addition to the gap analysis, the SST spent time in late 2015 discussing possible short-term actions that could be taken to better understand salmonid survival in the Delta in 2016. Based on these discussions, the SST provided a recommendation to CAMT for acquisition of additional acoustic receivers to leverage existing planned fish releases in 2016. After receiving CAMT and Policy Group support, the SST is currently implementing the short-term action.

2.1.5 Habitat Restoration

Early on, CAMT discussed the inclusion of habitat restoration as an additional high priority topic area. The existing BiOps include habitat restoration requirements, and habitat restoration is viewed by all CAMT members as critical to the long-term recovery of listed species. Despite its recognized importance, CAMT did not include habitat restoration in its 2014 Workplan due to concerns regarding available capacity. CAMT did include habitat restoration in its 2015 Workplan, but was not able to find the time or resources to scope potential investigations. CAMT continues to believe habitat restoration is an important topic area to pursue and has identified it as a goal for 2016 (see Section 3).

2.2 Program Management

The CSAMP relies on a combination of agency staff and contractor support to conduct its work, including program planning and science investigations. It is estimated that CSAMP participants contributed approximately 4.5 full-time equivalents (FTEs) in the form of in-kind staff commitments to the Program in 2015. In addition to existing staff resources, approximately $1.3 million was expended in 2015 for contracted support, including funds for technical studies.

Program activities are generally classified according to the following:

1. **Management and Facilitation:** Includes: (a) management and facilitation of Policy Group meetings, CAMT meetings, and Scoping Team meetings; (b) management of contracts for CAMT support and technical investigations; and (c) planning and coordination, including development of annual work plans and budgets.
2. **Sponsored Participants:** Provides funding for contractors representing NGOs and PWAs on CAMT and scoping teams, including the Salmon Scoping Team co-chairs.
3. **Technical Studies:** Represents investigations developed based on extensive dialogue within the CAMT Delta Smelt Scoping Team (DSST) and Salmon Scoping Team (SST).

4. **Peer Review:** Includes coordinating with and funding independent peer reviews through the Delta Science Program (DSP).

Table 2 provides a breakdown of 2015 capital expenditures according to the categories listed above. Table 3 provides a summary of capital expenditures by participating entity, not including in-kind staff contributions.

Significant effort was expended in 2015 to secure the funding and staff commitments necessary to complete the work that was initiated in 2014. Beyond funding to operate the program in 2015, CAMT secured funding and staff commitments to continue the CSAMP through 2016, including $2.5 million to complete all the high priority work plan elements identified in 2014. Details regarding the CSAMP budget for 2016 are provided in Section 3.

In addition to securing funding and staff commitments, CAMT expended significant time and resources in 2015 to negotiate and execute contracts necessary to implement technical studies. Contracts for three of the four technical studies were executed in 2015. Contract negotiations for the fourth study - Fall Outflow Management for Delta Smelt are underway and are expected to be completed in the first quarter of 2016.

CAMT also spent time in 2015 working with the Policy Group to establish a more refined project workflow process that better defines roles and responsibilities and key decision points in terms of identifying study needs, securing funding, and managing projects. Figure 1 provides a graphical depiction of a generalized workflow process for new studies. The process is specifically intended to allow for parallel activities designed to shorten the amount of time required to develop study proposals, secure funding and execute contracts.

2.3 Challenges in 2015 and Moving Forward

Key challenges encountered in 2015 that will need to be addressed in the future are:

- **Speed of Progress.** When the CSAMP was established in 2013, it was envisioned that it would inform implementation of the current Biological Opinions, including interim operations, and the development of revised Biological Opinions within the three-year window of the Court extensions. While a lot has been accomplished in the first three years of the program, progress on the initial set of priority actions has been significantly slower than many had hoped. Moving forward, the challenge will be to implement the proposed workflow process for new studies with a goal of shortening the amount of time involved in progressing from identification of management needs to recommendations for management action.
- **Ensuring Adequate Resources.** The 2015 Annual Progress Report identified committed resources, including availability of the right people, money, and time

to produce credible products as a limiting factor for CSAMP. This challenge remains in 2016.

- **Contracting.** Procurement was a significant challenge in 2015, particularly in the amount of time required to negotiate and execute contracts. To some degree, the time requirements are a function of public procurement that cannot be shortened. However, CAMT has identified some potential strategies for gaining efficiencies through more advanced planning and development of master service contracts in parallel with study scoping activities (as shown in Figure 1). CAMT is also exploring more contract management resources.
- **Ensuring Management Relevance of Scientific Investigations.** To date the CSAMP has focused on the development and evaluation of scientific information. As the existing investigations are completed, CAMT will need to initiate discussions on the management relevance and application of the findings.

Table 2 – 2015 Capital Expenditures

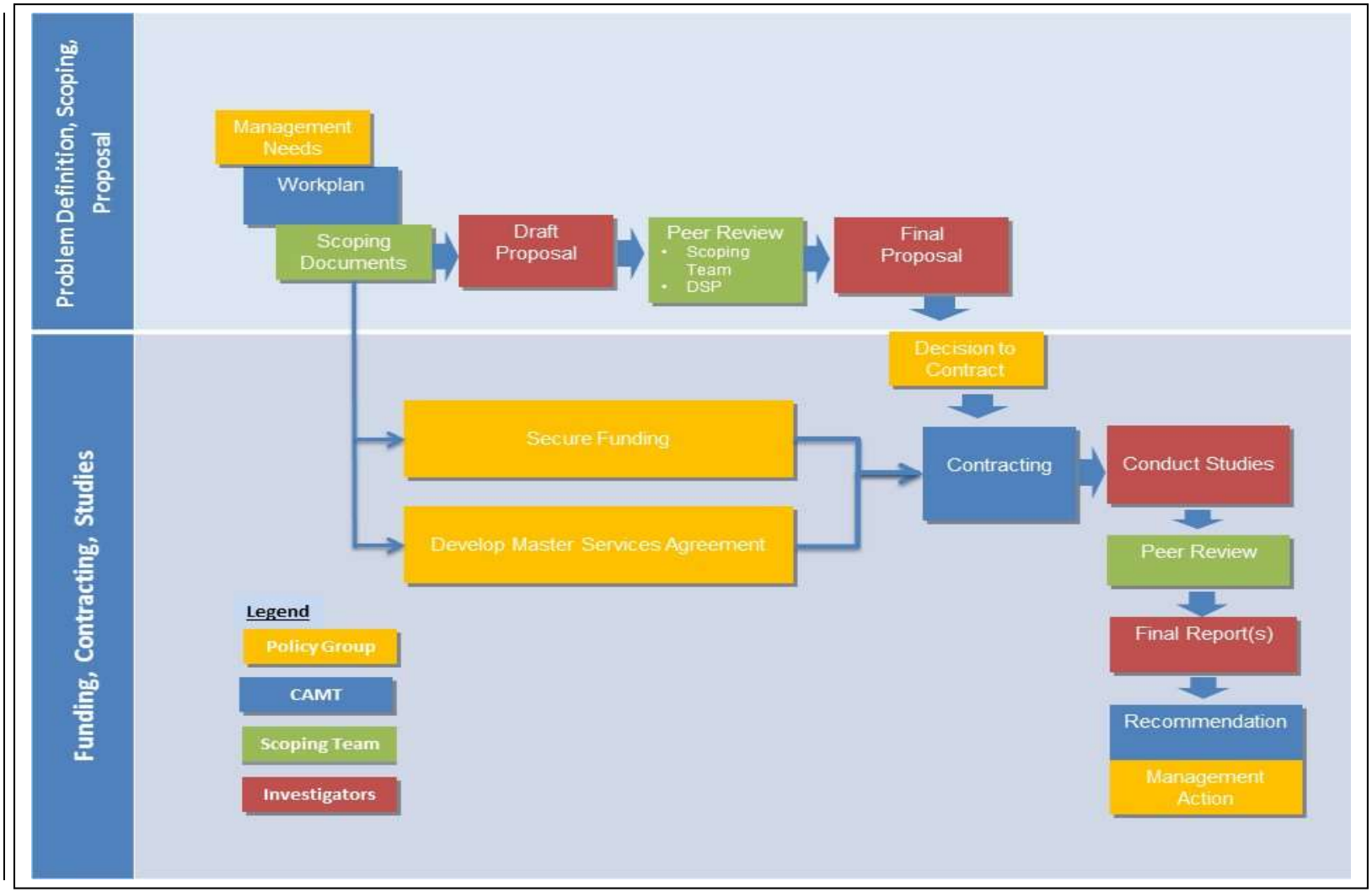
Activity	Expenditure
Management and Facilitation	$ 322,000
Sponsored Participants	$ 450,000
Technical Studies	$ 447,000
Peer Reviews	$ 80,000
Total	**$ 1,299,000**

Table 3 – 2015 Capital Expenditures by Entity

Entity	Amount
NMFS	$ 113,000
USBR	$ 160,000
DWR	$ 383,000
PWA-Coalition[1]	$ 643,000
Total	**$ 1,299,000**

[1] SWC, SLDMWA, Coalition, MWD, SFCWA

Figure 1 - Generalized CSAMP Workflow Diagram



3.0 CAMT 2016 Workplan

To date, CSAMP has focused on controversial science issues directly related to the court-ordered remand schedule for completing revisions to salmonid (NMFS 2009) and Delta Smelt (FWS 2008) Biological Opinions. Moving forward, it has been suggested that the CSAMP could expand its scope to address other policy-science interface issues and adaptive management needs. While there are opportunities to leverage the trust built among CAMT and Policy Group members, CAMT recommends that its primary focus be on finishing what it has started. Specific goals and work plan activities for 2016, as well as a 2016 budget are described below.

3.1 Goals

CAMT has identified the following eleven goals for 2016:

1. **Continue the existing set of technical investigations and engage with investigators to understand and discuss findings and management implications (salmonids and smelt).** As studies are completed, there will be a need to ensure CAMT members thoroughly understand the findings and have an opportunity to discuss management implications with the Policy Group.
2. **Develop management relevant information.** Continually strive to keep existing technical investigations focused on developing management relevant information that can assist in an evaluation of the effects of Project operations and other activities on target species and identification of management actions to address those effects in adaptive frameworks. Consider and recommend potentially relevant conservation and mitigation measures.
3. **Complete Gap Analysis Report (GAR) and initiate long-term study planning.** Completing the GAR is a major milestone for CAMT, which will set the stage for future CAMT activities including the evaluation of alternative management actions and a long term study plan for salmonids.
4. **Secure funding, streamline the contracting and funding process and establish contracting mechanisms, including competitive solicitations, for additional technical studies.** Securing longer-term funding and contract mechanisms to support future studies will be a major focus in 2016, including competitive solicitations for future studies.
5. **Build capacity.** Additional capacity in the areas of program and contract management has been identified as a need for CSAMP moving forward. Additional study initiatives will also require additional capacity both in terms of scoping activities and implementing investigations.
6. **Establish greater transparency.** In 2016 CAMT will establish a program website and host periodic public briefings.
7. **Improve coordination with IEP.** CAMT will continue to coordinate with IEP to avoid potential redundancies and maximize opportunities for synergies and efficiencies.

8. **Clarify roles and responsibilities within CSAMP.** The roles and responsibilities of the Policy Group, CAMT, and the scoping teams will be clarified to avoid confusion (see Attachment A).
9. **Clarify potential engagement on CA WaterFix.** Draft CA WaterFix documents mention CSAMP as a resource and contributor to adaptive management.
10. **Prepare a Five Year Workplan and budget for CSAMP.** Developing a five-year plan will provide a longer-term vision and context for planning and budgeting. CAMT has identified 5 years as a reasonable planning horizon that provides an opportunity for a long-term vision and sufficient time for science investigation and management action.
11. **Initiate discussions regarding habitat restoration.** CAMT has postponed such discussions over the past 3 years due to limited capacity. Now that several CAMT studies are underway, CAMT has more capacity to scope potential habitat restoration investigations.

3.2 Planned Activities

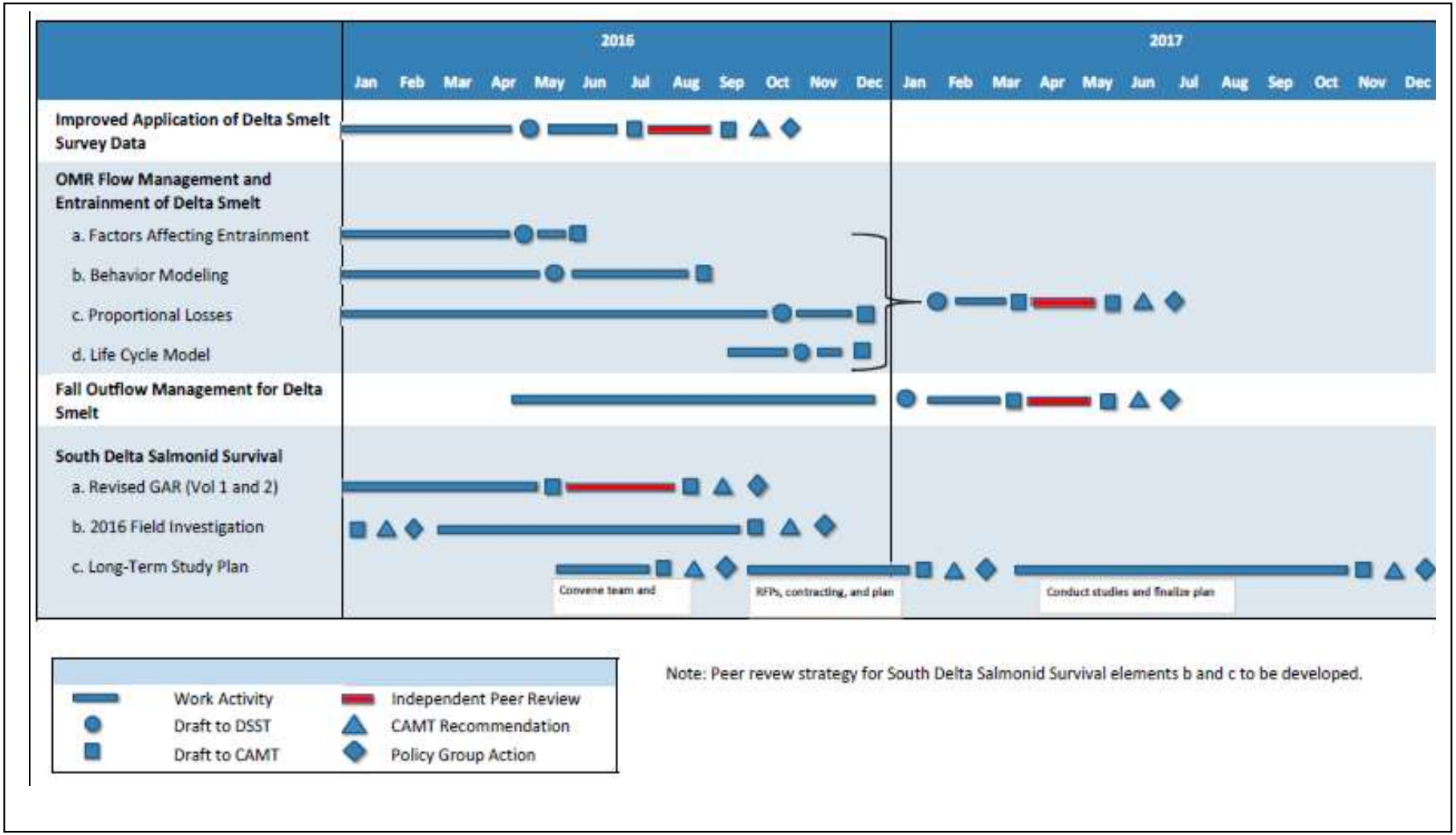
Planned activities for 2016 are designed to achieve the goals articulated above, including discussing the potential management implications of study findings and laying a framework for the CSAMP over the next five years. Activities also include planning for future technical studies, depending on the outcomes of the Five Year planning discussions. Table 4 lists specific planned activities for 2016. Figure 2 and Attachment B provide more details regarding ongoing technical studies.

Table 4 – 2016 Workplan

Planned Activity	Comments	Schedule
Management and Planning		
1. Discuss study findings and management implications	Policy Group, CAMT, and Scoping Team discussions	Quarterly and monthly meetings
2. Prepare Five Year Plan	To be initiated with a series of Policy Group interviews	Q1 – Interviews Q2 – Plan development
3. Initiate future study planning	Based on Five Year Plan	Q3
4. Secure funding and prepare requests for proposals	Based on Five Year Plan and initial study planning. May involve execution of an MOU.	Q3

5. Solicit studies and execute contracts	May include analyses of existing information and/or new field experiments.	Q4
6. Website and public briefings	Website to be hosted and maintained by DWR	Website in Q2, Briefings TBD
Technical Studies		
7. Improved Application of Delta Smelt Survey Data	See Attachment B	See Figure 2
8. OMR Flow Management and Entrainment of Delta Smelt	See Attachment B	See Figure 2
9. Fall Outflow Management for Delta Smelt	See Attachment B	See Figure 2
10. South Delta Salmonid Survival a. Complete GAR b. 2016 Field Investigation c. Long-term Planning	See Attachment B	See Figure 2

Figure 2- Technical Study Schedule



3.3 Budget

On December 17, 2015, the CSAMP Policy Group approved a budget of $3,090,000 to sustain CSAMP activities through 2016. In January 2016, the Policy Group approved an additional $125,000 to supplement salmonid field studies in 2016, bringing the total 2016 budget to $3,215,000. Table 5 provides a breakdown of the budget by the four major program elements. Table 6 provides a breakdown for the technical studies. Table 7 provides a breakdown of funding commitments by CSAMP participants.

The 2016 budget includes projected expenditures to: (1) operate and sustain the CSAMP, (2) engage the DSP to provide peer reviews that are critical to maintaining a credible process, and (3) scope and fund scientific investigations. The budget is for 2016 activity only. Some of the technical studies listed in Table 4 began in 2015 and extend into 2017, as shown in Figure 2. Funds have been committed to complete these studies, but the costs for activities beyond 2016 are not included in the 2016 budget.

Table 5 - 2016 Budget

Activity	Budget
Management and Facilitation	$ 289,000[2]
Sponsored Participants	$ 436,000[2]
Technical Studies	$ 2,290,000
Peer Reviews	$ 200,000[3]
Total	**$ 3,215,000**

[2] Assumes that current contracts will be extended through 2016. Does not include committed staff time.
[3] Estimate.

Table 6 - 2016 Technical Studies

Study	Description	2016 Budget
Improved Application of Delta Smelt Survey Data	Review Delta Smelt survey data	$ 100,000
OMR Flow Management and Entrainment of Delta Smelt	Assess factors affecting adult Delta Smelt entrainment and associated population effects	$ 800,000
Fall Outflow Management for Delta Smelt	Investigate effects of fall outflow on Delta Smelt	$ 700,000
South Delta Salmonid Survival	Initiate recommendations from GAR	$ 565,000
2016 Salmonid Field Investigation	Supplement 2016 salmonid field studies to improve survival estimates	$125,000
Total		**$ 2,290,000**

Table 7 - 2016 Funding Commitments

Entity	Commitment
NMFS	$ 140,000
DFW	$ 125,000
USBR	$ 1,175,000
DWR	$ 889,000
DSP	$ 450,000
PWA-Coalition[4]	$ 436,000
Total	**$ 3,215,000**

[4] SWC, SLDMWA, Coalition, MWD, SFCWA

3.4 Coordination with Other Science and Monitoring Programs

In 2016, CAMT will continue to leverage existing activities and monitoring to add value and avoid duplication of efforts. This may include reviewing ongoing data collection and monitoring programs to assess the need for possible refinements that could improve the applicability of the data for evaluating the key questions and hypotheses articulated by CAMT. Responsibility for coordinating and integrating CAMT activities with other ongoing studies will rest with the CAMT and its scoping teams.

CAMT will continue to work with the DSP in 2016 to provide independent peer reviews with the goal of increasing the quality of the work performed and ensuring scientific credibility in the process.

There are several research programs and adaptive management efforts outside of the CSAMP. The CSAMP does not replace those efforts or reduce their importance. Instead, the CSAMP will supplement and inform them.

The CSAMP will continue to strive to provide a new approach to integrating stakeholder points of view into these processes, or to create new groups if necessary to collaboratively address BiOp-related questions. The CAMT intends to ensure that disagreements about the basis for, and effectiveness of the reasonable and prudent alternatives (RPAs) be addressed by a science-based process that is legitimate, credible, and relevant to agency and stakeholder concerns.

ATTACHMENT A

Draft Roles and Responsibilities

CSAMP Policy Group

The Policy Group is the governing board of CSAMP. The role of the Policy Group is to provide leadership and direction to CSAMP by identifying key issues, prioritizing work efforts, providing necessary resources and ensuring work products are responsive and management-relevant. The Policy Group will do the following:

- Suggest alternative management actions for investigation
- Prioritize work topics
- Develop secure funding for CSAMP
- Provide direction to CAMT
- Commit necessary staff resources
- Approve annual work plans and budgets
- Approve all work products
- Recommend alternative management actions to agencies with jurisdictional authority
- Recommend metrics and monitoring program elements to relevant agencies

Collaborative Adaptive Management Team (CAMT)

The CAMT is the managing entity of CSAMP and is the interface between policy and science. The CAMT role is to establish the framework in which science is conducted, issues are addressed, and work products are developed. The CAMT manages the Scoping Teams and ensures that legitimate, credible and relevant science is produced. CAMT's role is also to interpret the management implications of the science and recommend actions to the Policy Group. CAMT will do the following:

- Ensure that a legitimate, credible and relevant structured science process is implemented, effective, and efficient
- Establish goals and objectives of scientific and related work
- Generate a framework for investigation of scenarios proposed by the Policy Group
- Coordinate with other science programs to leverage opportunities and avoid duplication
- Provide direction to Scoping Teams, review scoping team budgets and work products
- Recommend approval of proposals for funding
- Review work products from the Investigative Teams and other experts engaged to carry out science-related tasks, including analyses of candidate management actions
- Review metrics and monitoring programs to assess effectiveness of alternative management actions
- In conjunction with the Delta Science Program (DSP), arrange independent review of work products (proposals and reports) from the Investigative Teams, including providing input to review panel participants and review questions.
- Interpret management implications of the results of completed studies and recommend actions to the Policy Group

Scoping Teams

The purpose of Scoping Teams is to identify, design and articulate work plan investigations, interact with scientists, resource managers, and consultants undertaking related work, report progress, uncertainties and concerns back to the CAMT, and develop work plans acceptable to CAMT. Scoping Teams will do the following:

- Develop problem statements and identify key questions and critical uncertainties relevant for addressing Policy Group scenarios
- Define spatial and temporal boundaries for analysis
- Develop refined management-focused conceptual models acknowledging and building from current conceptual models and pertinent, ongoing science activities
- Provide scoping direction to Investigative Teams
- In conjunction with the Investigative Teams, articulate hypotheses to facilitate assessment and resolution of disagreements and uncertainties
- In conjunction with CAMT, ensure Investigative Teams produce reports responsive to the scenarios proposed by the Policy Group
- In conjunction with the DSP, provide input to independent review panel participants and review questions

Investigators

Investigators design and perform the scientific investigations to address the key questions and critical uncertainties developed by the Scoping Teams. Science investigations would be performed by qualified technical experts, identified and recommended by the Scoping Teams, and approved by CAMT. Investigations may be performed by individuals or teams of individuals. Investigators will do some or all of the following:

- Specify conceptual models that articulate biological and physical relationships, environmental stressor effects, ecosystem linkages and pathways, and the influence of management actions
- Construct and refine hypotheses in conjunction with Scoping Teams
- Propose experimental design and/or analyses capable of addressing critical areas of uncertainty
- Harvest and critically assess data from prior and ongoing studies and analyses
- Synthesize available scientific information, assess its reliability, and acknowledge uncertainties
- Construct quantitative models linking alternative management actions to environmental responses
- Verify and validate quantitative models
- Identify available data, or design and conduct studies to collect data necessary to test selected hypotheses
- Test hypotheses using the best available data, contemporary analytical tools and quantitative models
- Recommend metrics and monitoring programs to assess effectiveness and efficiency of management actions
- Evaluate candidate management action scenarios in an appropriate analytical, cost-benefit framework

Reviewers

Structured reviews will be organized and managed by the Delta Science Program with input from the CAMT and Scoping Teams for both study plans and work products resulting from investigations. Reviewers will do the following:

- Understand the purpose and scope of the study, and the scope of the review
- Critically review work products under the directives of the DSP and the pertinent Scoping Team, communicating as necessary among Review Team members.
- Provide constructive feedback to the Investigative Team to improve the relevance and quality of products
- Produce reports summarizing findings

Facilitators

Facilitators serve to keep the program on schedule, on budget and focused on providing products responsive to the needs of CSAMP. Facilitators will do the following:

- Provide coordination between all levels of CSAMP
- Organize agendas and schedules responsive to needs
- Facilitate meetings
- Assist with the development of key documents
- Produce monthly and annual progress reports and financial statements
- Facilitate development, execution, and tracking of contracts

ATTACHMENT B

Summary of Ongoing Technical Studies

Table B1 - Delta Smelt Surveys

Investigator	Dr. Robert Latour
Description	Address foundational assumptions that underlie data analysis methods used to draw conclusions about the population status of Delta Smelt in the Delta.
Key Questions	1. Are there specific covariates that significantly affect catchability of Delta Smelt by the FMWT and SKT survey programs? 2. If changes in survey catchability for Delta Smelt are detected, can 'correction' factors be applied to Delta Smelt survey data for the purpose of generating alternative FMWT and SKT abundance indices? 3. Is there evidence of temporal/spatial autocorrelation among survey samples of Delta Smelt collected by the FMWT and SKT survey programs? 4. If notable temporal/spatial autocorrelation is detected, can Delta Smelt abundance indices be re-estimated?
Management Relevance	Formally evaluating key assumptions regarding catchability and sampling independence is critical to ensuring that the survey programs in the Delta are providing reliable and accurate population metrics for Delta Smelt. Understanding the accuracy of the survey data is essential for evaluating the effectiveness of current management actions, and identifying potentially more effective alternative actions.
Deliverable	Formal testing of the underlying assumptions regarding current survey techniques and recommendations for possible correction factors that could improve the quality and effectiveness of management actions.
Start Date	January 1, 2016
End Date	September 30, 2016
Total Budget	$ 100,000
2016 Budget	$ 100,000

Table B2 - Delta Smelt Entrainment

Investigators	Lenny Grimaldo – Principal Investigator, Rick Deriso, Edward Gross, Josh Korman Pete Smith, Mark Maunder, Michael MacWilliams, Matt Nobriga
Description	Four interrelated investigations to assess the factors that affect Delta Smelt entrainment and the population consequences of entrainment: Study 1 –Critically review the conceptual models that underlie adult Delta Smelt salvage and determine through multi-regression models the best suite of variables that explain historical salvage patterns. Study 2 - Evaluate adult Delta Smelt swimming behaviors and how those behaviors driven by the environmental conditions of turbidity, salinity, and Delta flows, affect adult Delta Smelt entrainment at the south Delta export facilities. Study 3 - Estimate proportional losses from entrainment of adult Delta Smelt at the SWP and CVP export facilities in the south Delta. Study 4 – Use existing life cycle model to understand the effects of entrainment on the Delta Smelt population.
Key Questions	See listing below
Management Relevance	Results from this study could be used to better characterize high risk and low risk scenarios for different operational decisions. They could also indicate how effective the RPAs have been at reducing entrainment. Results will also put entrainment in context with the overall population to estimate the effect of various entrainment levels on the Delta Smelt population as a whole, which will allow for more informed management decisions.
Deliverables	Modeling and analytical tools that could support adjustments and refinements to current RPAs that could provide better species protection and improvements to water supply reliability.
Start Date	June 1, 2015
End Date	May 31, 2017
Total Budget	$1,121,656
2016 Budget	$ 800,000

Key questions to be addressed by the entrainment proposal:

1. Is there a relationship between Delta Smelt distribution and habitat conditions (e.g. turbidity, X2, temperature, food) during fall and subsequent distribution and associated entrainment risk in winter?
2. What are the environmental conditions that "trigger" spawning migration?
3. How does the distribution of adult Delta Smelt vary at time scales not resolved by surveys, particularly during the spawning migration?
4. Which environmental conditions lead to adults entering the south Delta?
5. To what degree has implementation of the RPA reduced adult entrainment?
6. What are the salvage efficiencies of the major water export facilities?
7. What is the best feasible method for estimating the number of adults entrained by the water projects?
8. What is the relationship between salvage and entrainment, how variable is the relationship, and what factors influence that variability?
9. What are the effects of entrainment on the population?

Table B3 - Fall Outflow for Delta Smelt

Investigators	Erica Fleishman– Principal Investigator, Rick Deriso, Lenny Grimaldo, Nobel Hendrix, Mark Maunder, Robin Waples
Description	Identify environmental variables that are associated strongly with annual changes in survival during autumn and recruitment of Delta Smelt.
Key Questions	1. What is the strength of association between fall outflow, autumn survival and recruitment of Delta Smelt? 2. What is the strength of association between environmental covariates and autumn survival and recruitment of Delta Smelt if fall outflow is not included in the model?
Management Relevance	A better understanding of how fall conditions affect Delta Smelt survival and recruitment, and the role of outflows versus other environmental conditions could result in more effective management actions and potentially a revised RPA.
Deliverables	Modeling analyses that identify the significance of various factors on fall survival and the relative value of managing these conditions to provide species protection.
Start Date	March 1, 2016 - estimated
End Date	April 1, 2017 - estimated
Total Budget	$$748,322
2016 Budget	$ 700,000

Table B4 - Salmonid Gap Analysis, Long-term Study Plan, and 2016 Salmonid Field Investigation

Investigators	CAMT Salmon Scoping Team (SST), plus additional technical experts
Description	Finalize review and synthesis of available science on water project-linked effects on salmonid survival in the southern Delta. Provide recommendations for possible 2016 management actions. Initiate development of a long-term study plan. Supplement planned salmonid survival studies in 2016 by providing 12 additional JSAT receivers for deployment in the field to empirically test assumptions regarding trawl efficiencies.
Key Questions	See list below
Management Relevance	Salmonid survival in the southern Delta is a key factor considered by NMFS in the 2009 BiOp and recovery planning for assessing population resiliency and population recovery. There is a range of views regarding the effects of south Delta hydrodynamics, as affected by San Joaquin inflow and/or delta exports, on the survival of salmonids emigrating from the San Joaquin through the south Delta. The GAR will summarize areas of scientific agreement and disagreement and indicate fruitful areas for expending funds on additional research to narrow areas of disagreement. Deployment of additional JSAT receivers in 2016 will provide data to improve Juvenile Production Estimates (JPE) which are used to set take limits, and provide data for better estimates of in-Delta survival and abundance. Data will be primarily for Winter-run Chinook, but will also be available for Fall-run Chinook.
Deliverables	Results of the gap analysis will yield recommendations and guidance on future research needed to better understand the influence of water project-linked effects on juvenile salmonid migration and survival within the Delta. Reducing uncertainties in how management of water operations affect patterns of survival and mortality will promote more effective management actions.
Start Date	GAR - May 1, 2014

	2016 Investigations - February 2016
End Date	Gap analysis – April 30, 2016 2016 Investigations – October 30, 2016 Long-term Study Plan – December 1, 2017
Total Budget	$ 690,000 ($565,000 for long-term planning, $125,000 for 2016 field investigation)
2016 Budget	$ 690,000

Key management questions identified by CAMT in 2015 and addressed by the Salmonid Gap Analysis are:

1. To what extent do SWP and CVP export operations effect water velocity and flow direction at selected locations in the Delta, and to what extent do those changes influence salmonid migration rate, route selection and survival?
2. To what extent do either: (1) water exports; (2) inflows; or (3) the ratio of San Joaquin River inflow to water exports during April and May affect the survival of Chinook salmon or steelhead out-migrating down the San Joaquin River, particularly given very low ambient rates of survival and associated issues of detection?
3. To what extent does the January 1 onset of OMR flow management improve the survival of the target salmonid species?
4. To what extent do salvage-density-based export restrictions improve survival of targeted populations of Chinook salmon and/or steelhead?
5. In considering the effectiveness of flow metrics as a management tool, are there alternative or additional metrics (e.g., OMR flows, export volumes, monthly export limits, etc.) that could be used to manage south Delta water operations, and improve survival of migrating salmonids in the south Delta?
6. Are there biological response metrics that would be useful for assessing the effectiveness of RPA actions (for example, as suggested in Anderson et al. 2014, pages 5, 42)?
7. Do DSM2 Hydro and/or other available hydrodynamic models provide outputs that are appropriate and useful for assessing how exports from the south Delta, river inflows, and tides may influence the magnitude, duration, and direction of water velocities within selected channels and channel junctions in the Delta? What are the strengths and limitations of various simulation models and their application to assessing the relationship between water project operations and salmonid migration and survival?
8. What information is needed to address concerns that the results of tests using hatchery-reared fall-run Chinook salmon may not be representative of results of other runs of natural-origin salmonids? Could a correction factor be developed to allow for application of such test results?

Based on the SST review and responses to these questions (as well as other work conducted in the Gap Analysis), there are a number of short term actions being considered by the SST that are intended to inform the development of a long-term plan as recommended in the draft Gap Analysis Report. One of these short-term actions that was recommended to CAMT and funded in January 2016 was the purchasing of 12 additional JSAT receivers to supplement planned salmonid field studies in 2016. While the receiver deployment and data collection will be managed by others, the SST will assist in compiling and evaluating the data and will prepare a separate technical report as a CAMT product. The report will be prepared and delivered to CAMT in October 2016, then submitted to the DSP for a formal peer review.